

Open Architecture Overview National Defense Industrial Association Systems Engineering Conference

***CAPT Tom
Strei***

PEO IWS

***Open
Architecture***



Purpose of Brief



- ◆ **Explain Why New Approaches to Implementation of Warfighting Capabilities are Necessary**
- ◆ **Define OA Concepts as Applicable to Integrated Warfighting Systems**
- ◆ **Describe the Approach Being Used to Create and Deploy OA Systems**

Why OA?



- ◆ **Enables Required Combat Capability**

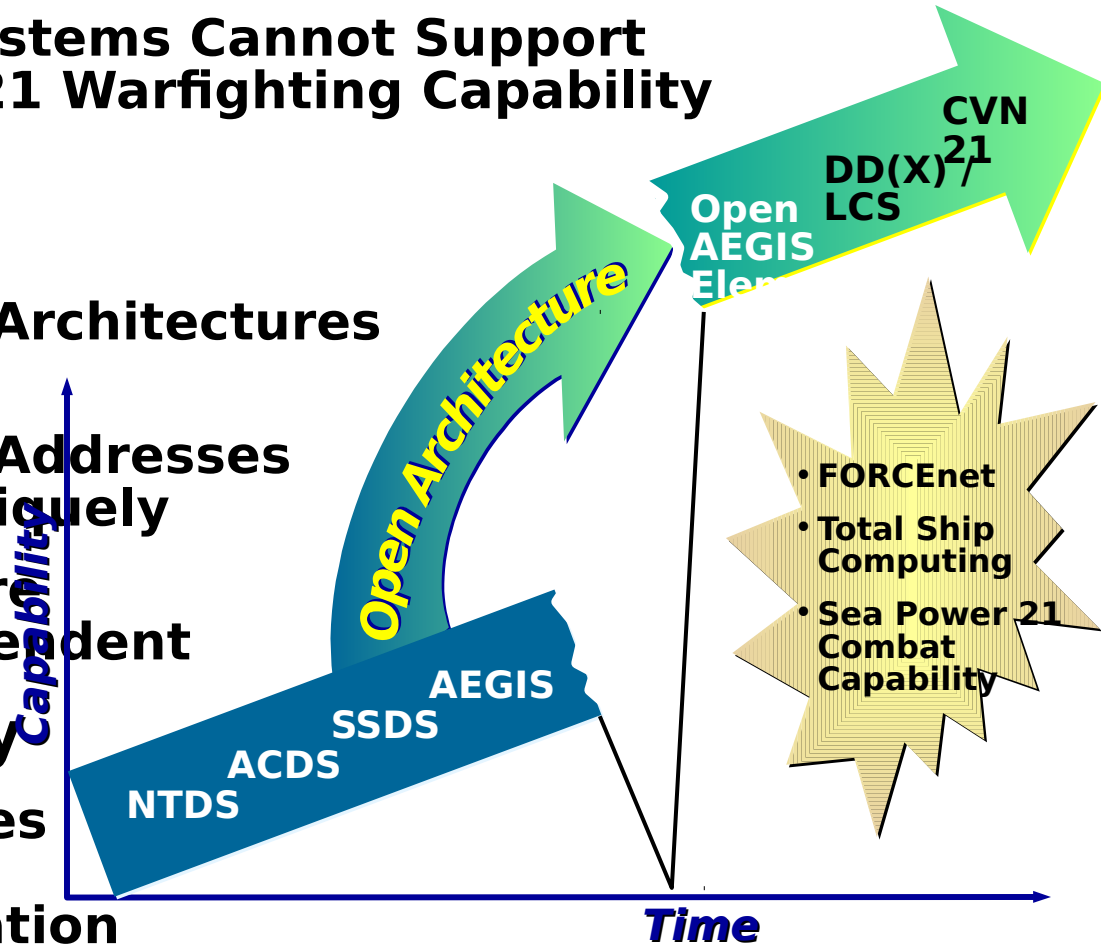
- Current Computing Systems Cannot Support Emerging Sea Power 21 Warfighting Capability Requirements

- ◆ **Affordability**

- In-service Computing Architectures are Unaffordable
- Each Warfare System Addresses Common Problems Uniquely
- Software and Hardware Changes Are Interdependent

- ◆ **Joint Interoperability**

- In-service Architectures can not Support FORCEnet Implementation

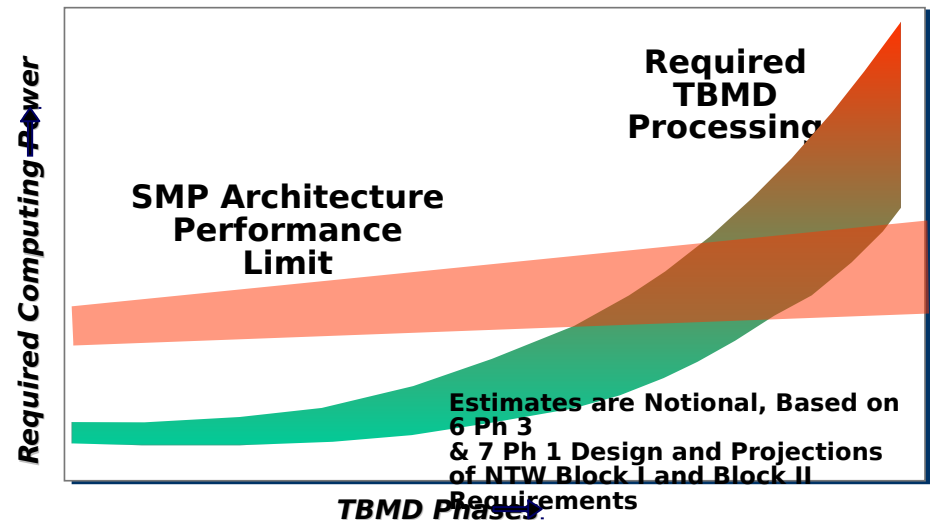
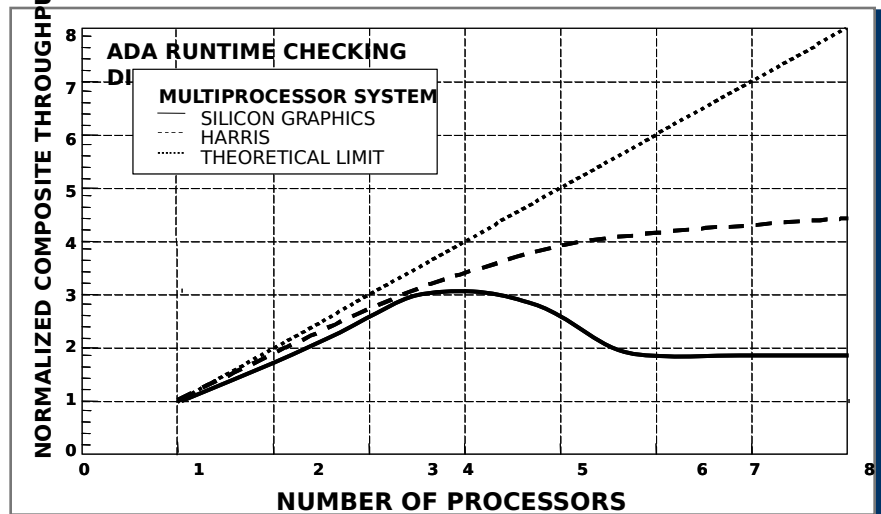


**Key to Affordable 21st Century Joint
Combat Capability**



Increased Warfighting Capability

- ◆ **Current Aegis Architecture Cannot Meet Processing Needed to Support TBMD Engagement**
- ◆ **OA Computing Plant Scalable to Meet Increased Processing Demand**



OA Enables "and Ship" Capability

Open Computing System Definition



Open Computing System: A System That Implements Sufficient Open Specifications for Interfaces, Services, and Supporting Formats to Enable Properly Engineered Components to be Utilized Across a Wide Range of Systems With Minimal Changes, to Interoperate With Other Components on Local and Remote Systems, and to Interact With Users in a Style That Facilitates

Key Open Computing System Characteristics:

- ◆ **Portability** — Based on Open, Publicly Available Specifications — Preferably Maintained as Standards by a Consensus Process, E.G., By an Internationally Recognized Governing Group
- ◆ **Force** — Well-defined, Widely Used Non-Proprietary (Standard) Interfaces, Services and Formats
- ◆ **Durable** (Stable or Slowly Evolving) Component Interfaces That Facilitate Component Replacement and Addition of New Capabilities
- ◆ **Upgradeable** Through Incorporation of Additional or More Capable Components With Minimal Impact on the System

What is OA?



- ♦ **A Technical Architecture... Mainstream Standards Based OA Computing Environment**

- Middleware
- Operating Systems
- Mainstream COTS Computing Technology

- ♦ **A Functional Architecture... Technical Reference Model That Identifies System Domains and Interface Relationships**

- Warfighting Applications
- Common Service Applications

- ♦ **Specifications, Standards & Design Guidance**

- ♦ **An OA Approach is an Integrated Technical and Business Strategy Focused on Increasing the Effectiveness of a Capability, While Decreasing Cost, Increasing Operational Life and Providing Improvements Through Planned Upgrades**

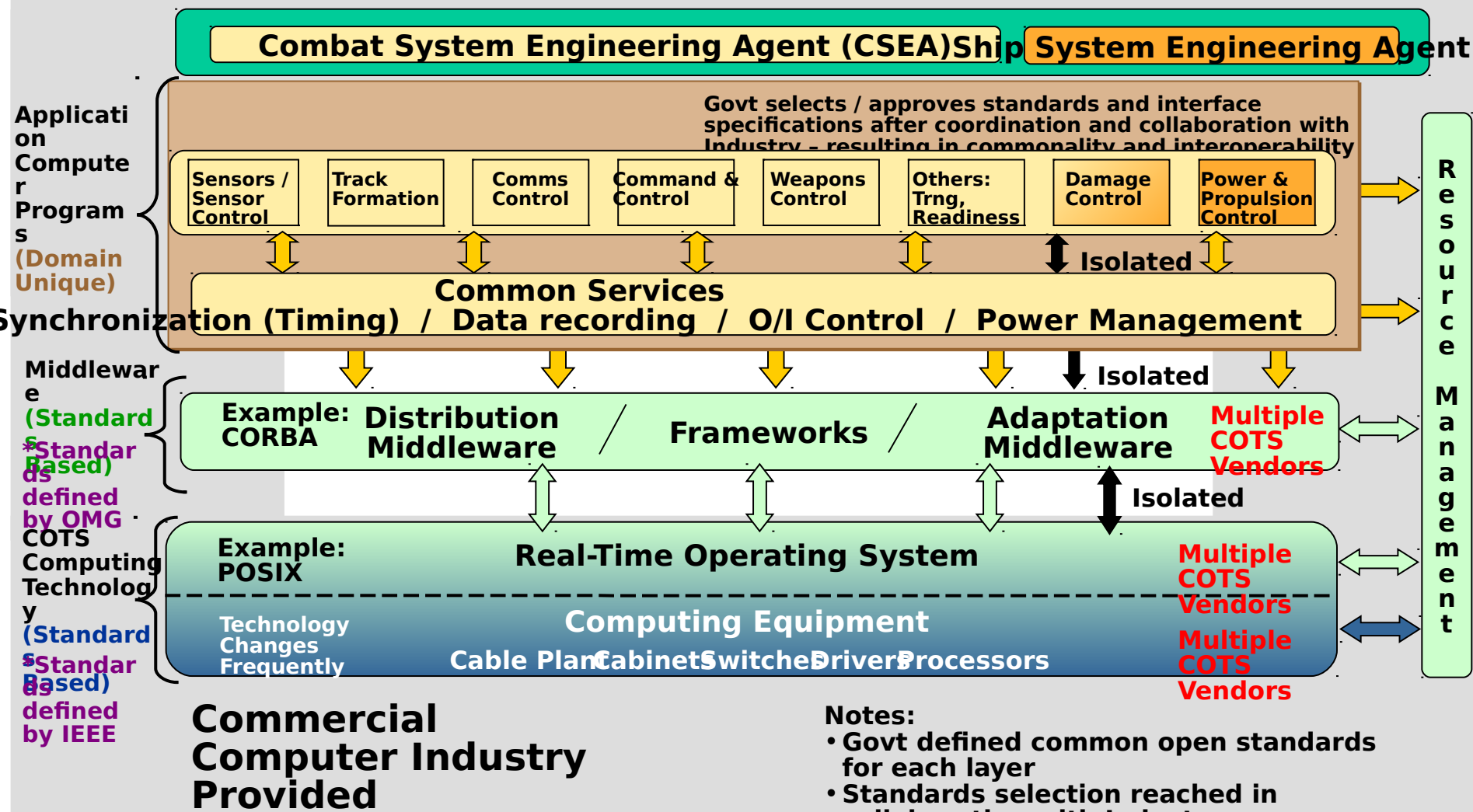
Key Open Computing System Characteristics

- ♦ Based on Open, Publicly Available Specifications
- ♦ Well-Defined, Widely Used Non-Proprietary (Standard) Interfaces
- ♦ Durable Component Interfaces

Decoupled Hardware and Software Upgrades

Foundation for 21st Century Combat System Designs

OA Technical Architecture

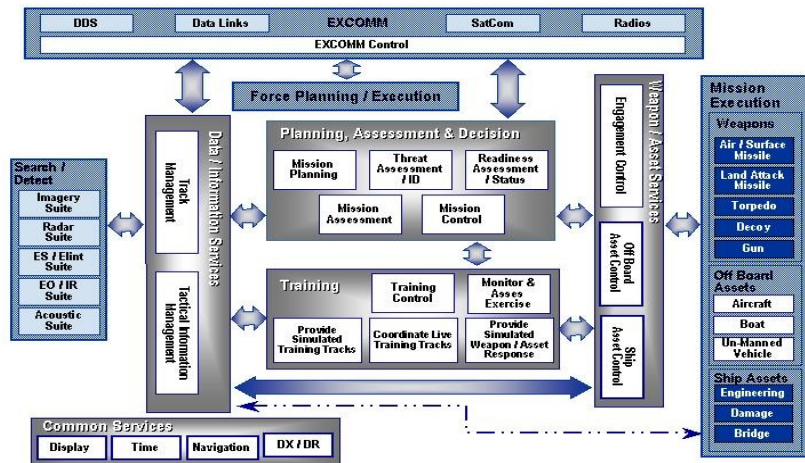


STANDARDS and MIDDLEWARE Isolate Applications From Technology Change

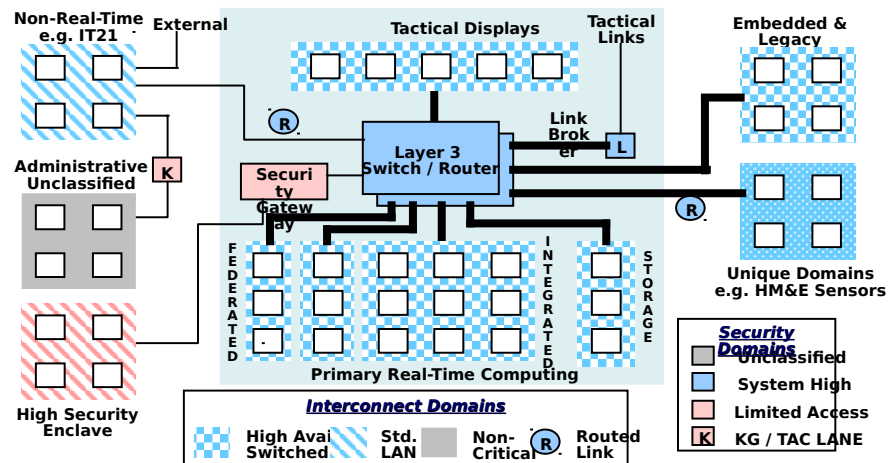
OA System Architecture Views



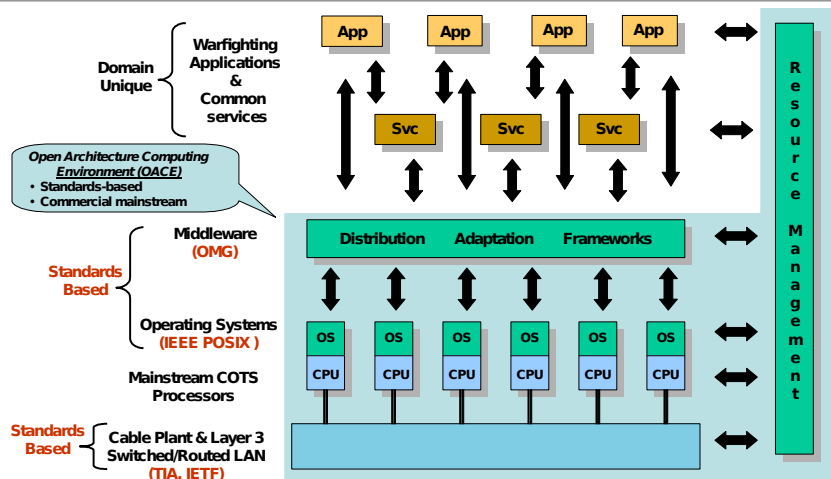
Functional View



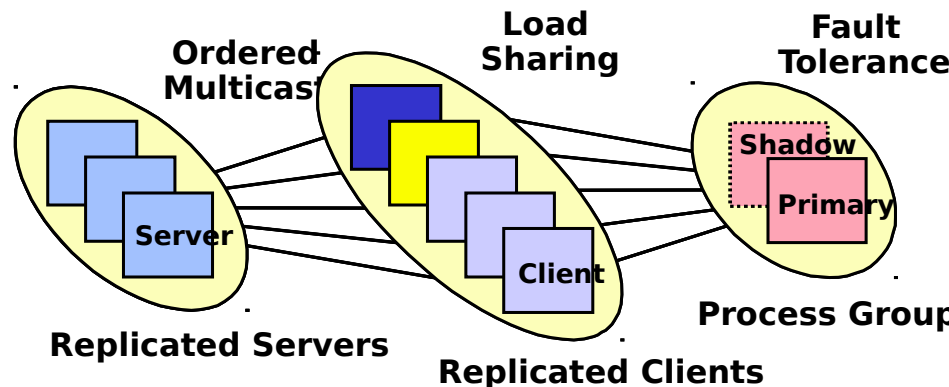
Network & Computer View



Operating System & Middleware View



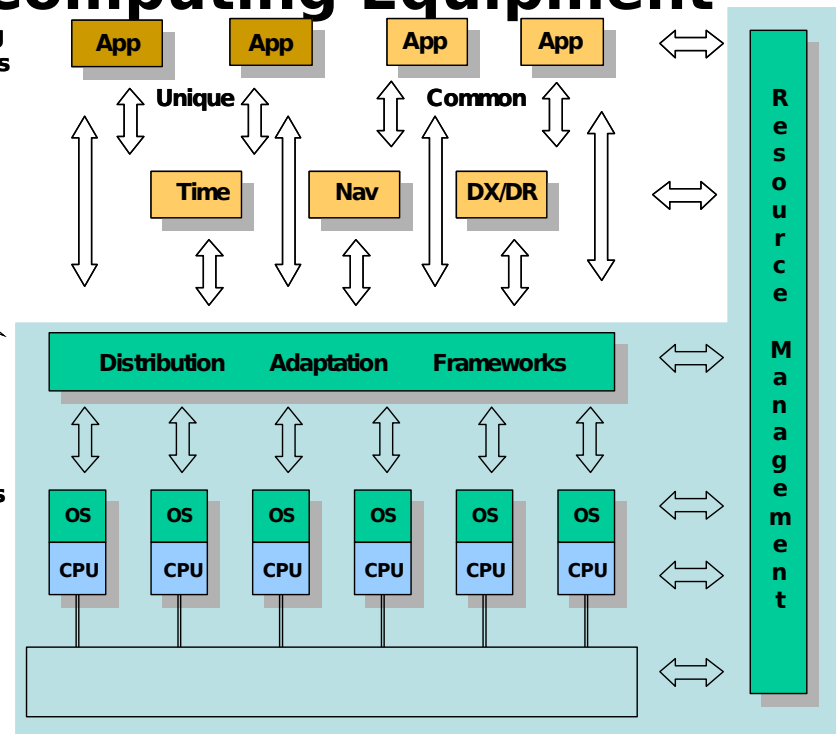
Computer Program View



OA Technical Architecture



- ◆ **Standards Based Computing Environment**
- ◆ **Includes Middleware, Operating System, Resource Management and Computing Equipment**
- ◆ **Enables Decoupling of Software to Hardware**
 - Warfighting Applications & Common services
 - Unique & Common
 - Time, Nav, DX/DR
- ◆ **Enables Affordable COTS Refresh and Technology Insertion**
 - Open Architecture Computing Environment (OACE)
 - Standards-based
 - Commercial mainstream
 - Middleware (OMG)
 - Operating Systems (IEEE POSIX)
 - Mainstream COTS Processors
 - Cable Plant & Layer 3 Switched/Routed LAN (TIA, IETF)
- ◆ **Utilizes Commercial Mainstream Computing Products**

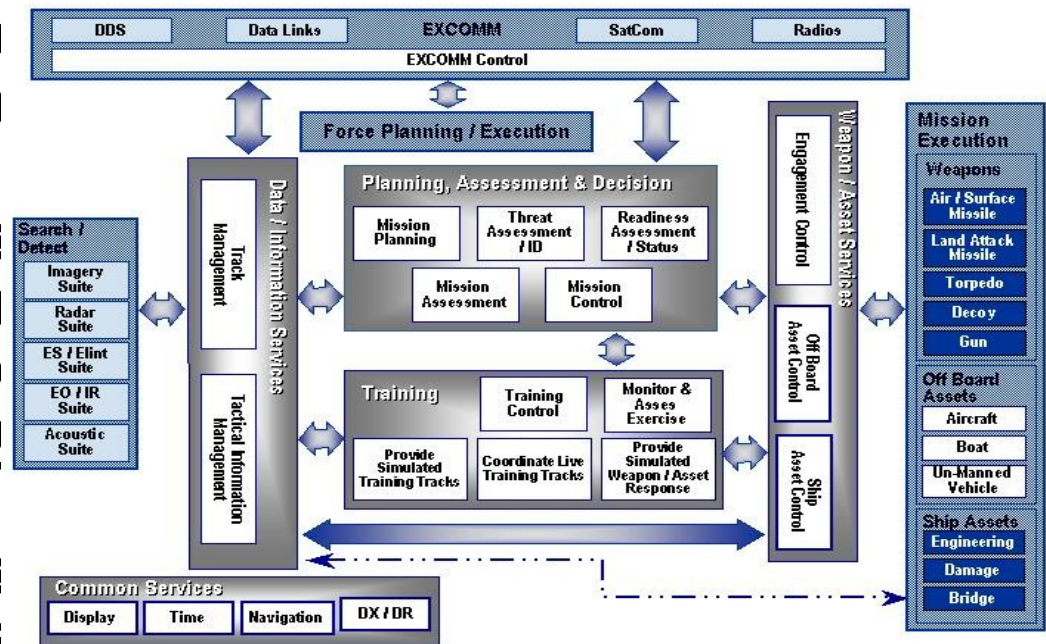


STANDARDS and MIDDLEWARE Isolate Applications From Technology Change

OA Functional Architecture



- ◆ Translates System Requirements to Functional Requirements and Allocates Functions to Logical Groupings
- ◆ Provides Basis for Identifying Common Service Applications and Co Warfighting Applica
- ◆ Provides Standardiz Common Component (e.g. C2, ID, etc) and Interfaces Across S
- ◆ Provides Standardiz of Design Patterns ;



Enabler For Application Re-Use Across Platforms

OA Platform and Process Concepts



Validation

OATF is . . .

- Gov't Controlled Risk Reduction
- Industry Devel. & Participation
- Common Functions & Services
- OA Computing Environment
- Stimulation of Unique Interfaces

OATF validates . . .

- OA Computing Environment
- Common Functions
- Total Commonality
- New Interfaces (RTIP)

Unique



UNIQUE INTERFACE UNIQUE INTERFACE UNIQUE INTERFACE UNIQUE INTERFACE UNIQUE INTERFACE

Common

**COMMON FUNCTIONS
ACROSS ALL SHIP CLASSES**

**Open Architecture Computing
(Common Environment & Guidance)**

Industry Builds Systems

- NAVY Control Interfaces

Collaborate with Defense Industry:

- Common Component Specifications for Industry to Build
- Interface Specifications

**Standards and Guidance:
Architecture,
Technologies, Products, Design
Methods**

S&T investigations

Info Transfer Middleware
Oper. Systems Resource Mgt.

Collaborate with Computing Industry

- Computing Standards
- Technology Base

Navy Controls

- Standards
- Specifications
- Interfaces

Open Architecture Standards, Guidance and Definition Document

Technical Architecture

Functional Architecture



Subj: OPEN ARCHITECTURE COMPUTING ENVIRONMENT (VERSION 1.0) AND OPEN ARCHITECTURE TECHNOLOGIES AND STANDARDS (VERSION 1.0)

together, these documents describe the and requirements for computing system combat systems. This unified set of documents provides significant insight into requirements, but they are not yet final and are being disseminated for review and initial assessment before proceeding as required by reference (a).

2. Similarly, the Program Executive C

DEPARTMENT OF THE NAVY
 COMMANDER SPACE AND NAVAL WARFARE SYSTEMS COMMAND
 PROGRAM EXECUTIVE OFFICE (COMNAVAIRISTSCOM) FOR INTEGRATED WARFARE SYSTEMS (IWS)
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 WASHINGTON NAVY YARD DC 20376-2301

9000 9000 9000 9000
 Ser SPANAR/150 Ser IWS/084 Ser SEA 06/027 Ser CAI and Space/098
 20 Mar 2003 20 Mar 2003 20 Mar 2003 20 Mar 2003

JOINT LETTER

From: Commander, Space and Naval Warfare Systems Command
 Program Executive Officer for Integrated Warfare Systems
 Deputy Commander for Warfare Systems Engineering
 Program Executive Officer, CAI and Space

Subj: OPEN ARCHITECTURE COMPUTING ENVIRONMENT DESIGN GUIDANCE (VERSION 1.0) AND OPEN ARCHITECTURE COMPUTING ENVIRONMENT TECHNOLOGIES AND STANDARDS (VERSION 1.0)

Ref: (a) DOD 4120.24W, DSP Policies and Procedures

Encl: (1) Open Architecture Computing Environment Design Guidance (Version 1.0)
 (2) Open Architecture Computing Environment Technologies and Standards Version 1.0
 (3) Re-usable Application Integration and Development Standards (Version 1.5)

1. The Assistant Secretary of the Navy for Research, Development and Acquisition (ASN (RDA)) assigned the Program Executive Office for Integrated Warfare Systems (PEO IWS) with responsibility for coordinating the introduction of Open Architecture (OA) into the Navy's combat systems. Computing technology is a key part of the OA effort. Therefore, as part of the OA tasking, and based on significant research and testing, the Naval Surface Warfare Center Dahlgren Division (NSWCDD) developed two supporting documents relevant to computing for OA. The Open Architecture Computing Environment Design Guidance, Version 1.0 (Interim) document provides interim guidance concerning design aspects of the standards-based computing environment that is to be used in OA warfighting systems. A companion document, Open Architecture Computing Environment Technologies and Standards, Version 1.0 (Interim), provides an enumeration of the standards and product selection criteria that apply to the OA technology base. Taken

Subj: OPEN ARCHITECTURE COMPUTING ENVIRONMENT DESIGN GUIDANCE (VERSION 1.0) AND OPEN ARCHITECTURE COMPUTING ENVIRONMENT TECHNOLOGIES AND STANDARDS (VERSION 1.0)

PRO C4I at edward.wunnen@navy.mil, or (619) 524-7595, and all technical comments on RAPIDS to Andrew Cox at andrew.cox@navy.mil

5. Your support is greatly appreciated

Andrew Cox *Ed Wunnen* *Chris Slusher* *K. D. Slusher*

D. F. SAURAN A. B. HICKS C. TY-SLUSH K. D. SLUSHER

N76, N77, N78

2.0, IWS 3.0, IWS 4.0, IWS 5.0, IWS 6.0

3

**OPEN ARCHITECTURE
 COMPUTING ENVIRONMENT
 TECHNOLOGIES AND STANDARDS**

Version 1.0 (Interim)

10 March 2003

DRAFT

**OPEN ARCHITECTURE
 COMPUTING ENVIRONMENT
 DESIGN GUIDANCE**

Version 1.0 (Interim)

10 March 2003

**RAPIDS
 RAPID APPLICATION INTEGRATION
 AND DEVELOPMENT
 STANDARDS**

PEO CAI and Space
 24 Feb 2002

**DRAFT
 V1.5**

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Subj: OPEN ARCHITECTURE (OA) FUNCTIONAL ARCHITECTURE DEFINITION DOCUMENT VERSION 1.0 (DRAFT)

Encl: (1) Open Architecture (OA) Functional Architecture Definition Document Version 1.0 (Draft)
 (2) Document Comment Form

1. Enclosure (1) provides the OA Functional Architecture Definition Document Version 1.0 (draft) for review and comment. This document defines a reference architecture for developing OA compliant combat system components and interfaces and serves as a basis for identifying common applications and services.

2. In order to begin the process of gaining consensus on a common Navy Functional Architecture, it is requested that your organization review the subject document and submit comments to Mr. Gary F. Minor via email (minor@nswc.navy.mil) by 31 July 2003. Comment submission should be provided using the document form provided in enclosure (2). All comments will be addressed and adjudicated with their originator prior to release of the next version, currently scheduled for 30 September 2003.

3. Questions or comments should be addressed to Mr. Gary Minor at (540) 653-1194 (minor@nswc.navy.mil).

T. J. O'SHEA
 By direction

Distribution to:

DAEN (IWS)
 COMNAVAIRISTSCOM (MCSA)
 COMNAVAIRISTSCOM (SEA 96)
 PRO (IWS) IWS T, 1.0, 2.0, 3.0, 4.
 PRO (CAI/SPACE)
 SPAWAR (WLO, DS)
 SIAP SETP (TD)
 NINCCO (B, F, G, J, K, N, T)

**OPEN ARCHITECTURE (OA)
 FUNCTIONAL ARCHITECTURE (FA)
 DEFINITION DOCUMENT
 VERSION 1.0**

DRAFT

JUNE 2003

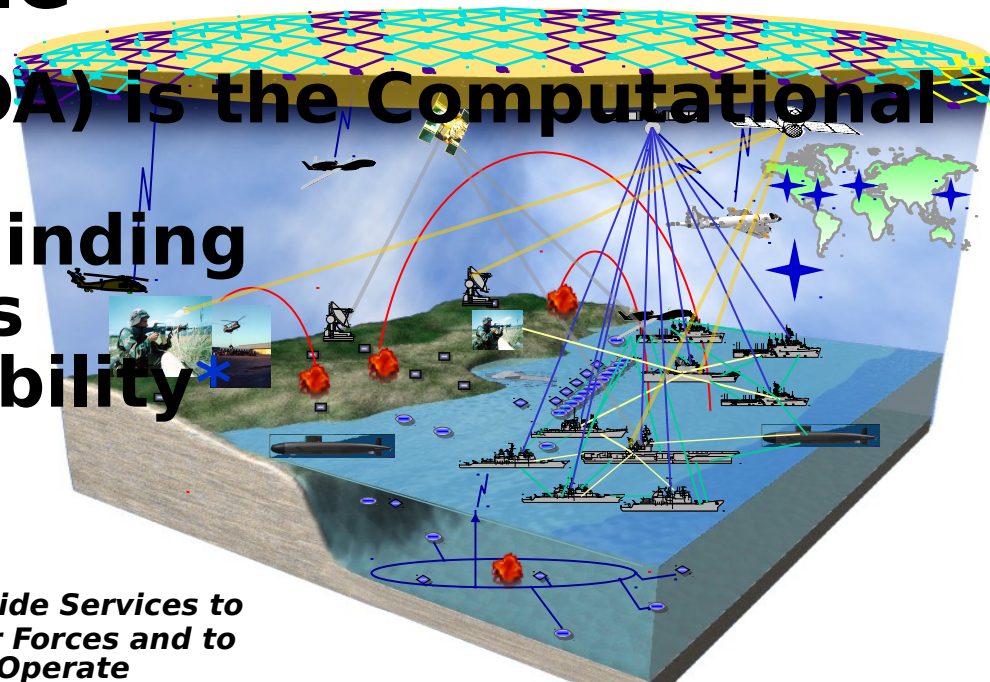
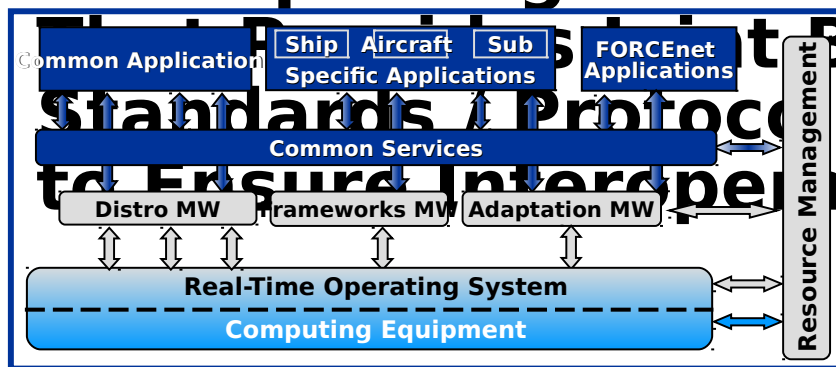
Prepared for:
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 Program Manager, Open Architecture (OA)
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Prepared by:
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 Dahlgren Division
 17430 Dahlgren Road
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Interoperability With a Netted Maritime



- ◆ Network Centric Warfare is Essential to Joint / Coalition Force Warfighting
- ◆ FORCEnet Leads the Maritime Architectural Framework for the GIG
- ◆ Open Architecture (OA) is the Computational Underpinning



* "The Ability of Systems, Units, or Forces to Provide Services to and Accept Services From Other Systems, Units, or Forces and to Use the Services so Exchanged to Enable Them to Operate Effectively Together." (JCS Pub 1)

Required to Realize FORCEnet Cost and Performance

The Underlying Concept of OA



Surface Combatant Ship System



**Common
Computing
Environment**

**Common
Functions**

**Surface
Combatant Ship
Unique Functions**

**SCS System
Unique & Common
Applications & Interfaces**

Aircraft System



**Common
Computing
Environment**

**Common
Functions**

**Aircraft Unique
Functions**

**ACFT System
Unique & Common
Applications & Interfaces**

CVN Ship System



**Common
Computing
Environment**

**Common
Functions**

**CVN Unique
Functions**

**CV System
Unique & Common
Applications & Interfaces**

Submarine System

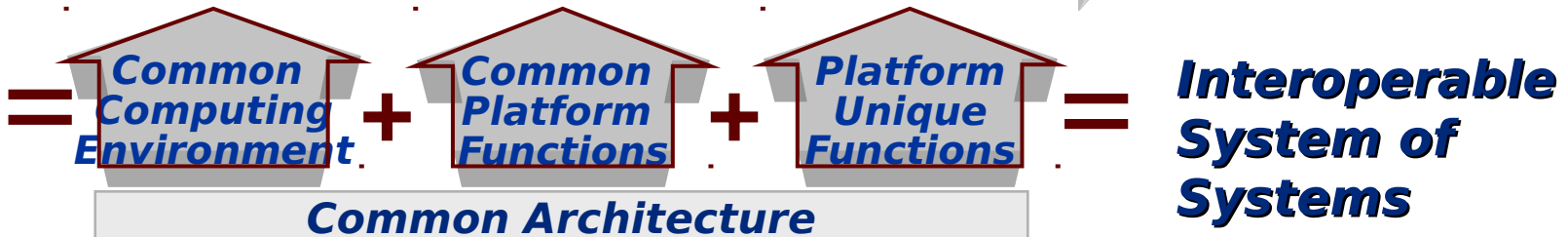


**Common
Computing
Environment**

**Common
Functions**

**Submarine
Unique Functions**

**Submarine System
Unique & Common
Applications & Interfaces**



OA Strategy



Current Ships (Back Fit)



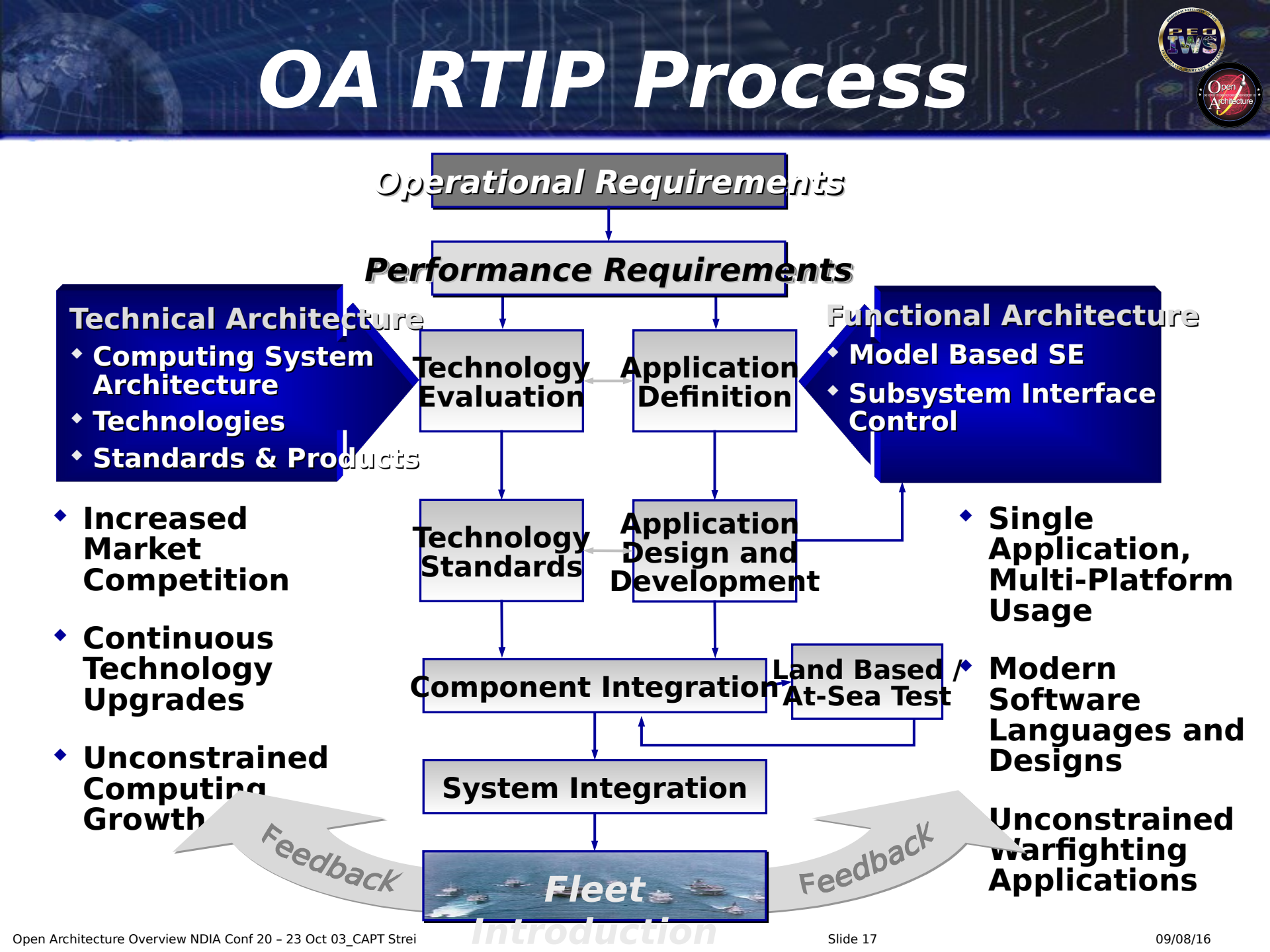
Future Ships (e.g. DD(X), LCS, CVN 21, LHA(R) etc.)

All C4I Systems

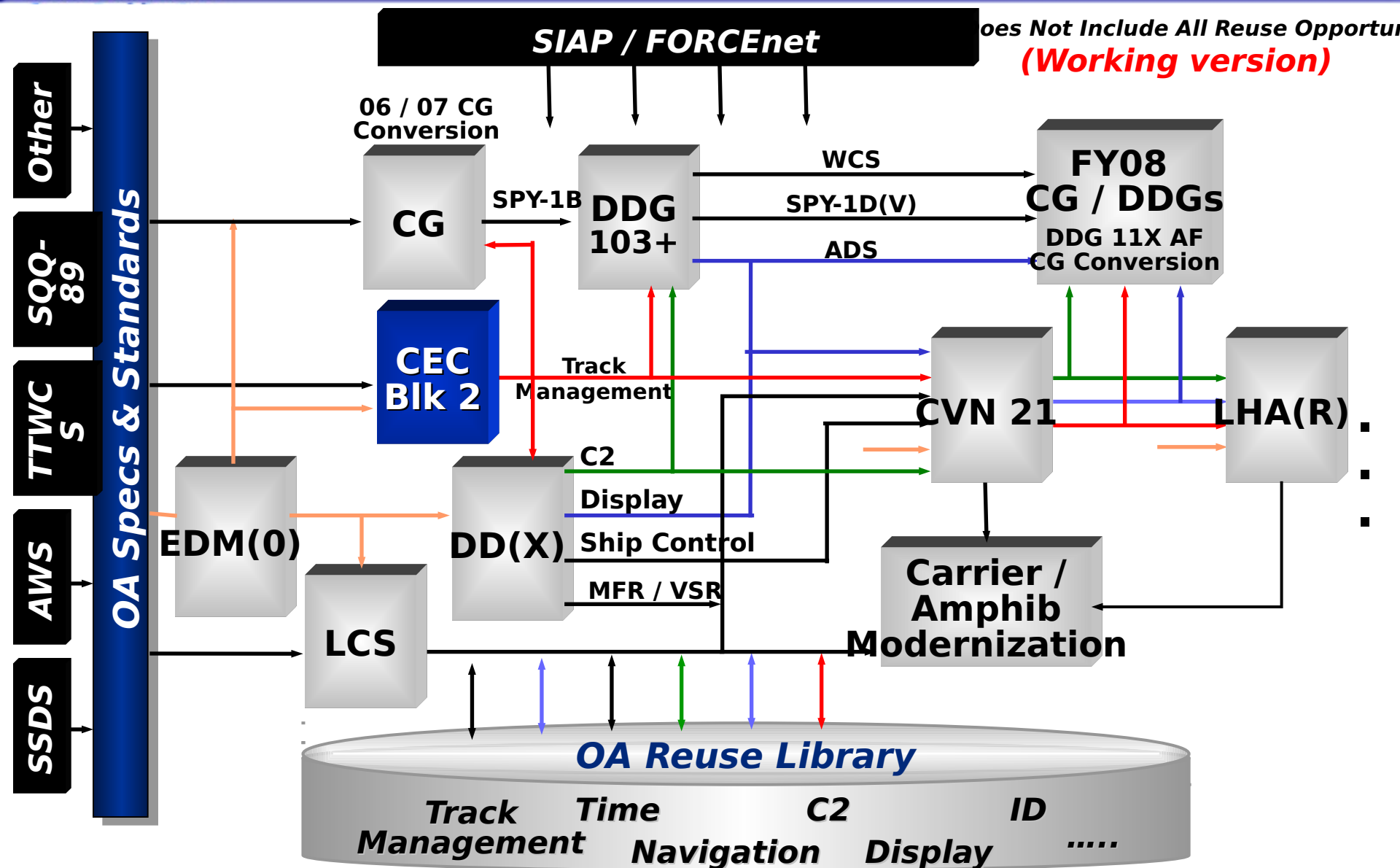
Net-Centric Concepts (e.g. FORCEnet, SIAB)

OA RTIP Process

Logos for the Department of Defense (DoD) and the Open Architecture (OA) program are visible in the top right corner of the banner.



Reuse Approach



Steps Already Taken



Policy

- ✓ Froze AEGIS and SSDS Future Upgrades to Sponsor Approved Requirements Only
- ✓ Rewrote CEC Blk II RFP to Include Requirement for an OA-Based Solution
- ✓ Released Interim Documents That Provide OA Specifications, Standards and Design Guidance
- ✓ Signed Cooperative MOAs With SPAWAR, SIAP and Ships
- ✓ Promulgated OA Contract Policy for All New Acquisition

Programmatic

- ✓ Stopped AEGIS B/L7p2 - AEGIS OA - Solution Too Narrowly Focused
- ✓ Redirected DD(X) From Vendor-WCK TSCE Solution
- ✓ Established OA Rapid Technology Insertion Program ("ARCI-like")
- ✓ Realigning Budgets to Support OA in PR05 and POM 06

Organizational Alignment

- ✓ Established PEO IWS OA Directorate
- ✓ Established OA Organization With Big Navy Involvement (ASN RD&A), OPNAV, SEA 06, Other PEOs, Field Activities)
- ✓ Significant Interaction With Fleet, Type Commanders, Systems Commands, Industry and Field Activities

Technical Alignment

- ✓ Discussions With OPNAV N61 Regarding Alignment of OA With FORCEnet
- ✓ NAVSEA 06 Assigned OA Technical Authority
- ✓ NSWCCD Designated OA Technical Team Leader
- ✓ Government / Industry Technical IPTs

Summary



- ◆ **Today's Fleet Computing Architectures are Performance Limited and Expensive to Upgrade**
- ◆ **Implementation of Warfighting Functions Using Standard Based Solutions Will Enable Common, Interoperable Capabilities to be Fielded Faster at Reduced Cost**
- ◆ **Rapid Technology Insertion Program (RTIP) Will Provide Structural Approach for Introduction of OA Components into the Fleet**